IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Inventor(s): M. H. Zarrabizadeh
Case: 22
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Examiner: J. W. Lee
Title: Watermarking Scheme For Digital Video

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SIR:

Appellant's Brief Under 37 C.F.R. 41.37

This is an appeal to the Board of Patent Appeals and Interferences from the Final Rejection dated January 6, 2010.

A Notice of Appeal was timely filed.

Real Party in Interest

The real party in interest is Alcatel-Lucent USA Inc..

Related Appeals and Interferences

There are no currently pending directly related appeals or interferences. There were appeals in related applications 10/673,894, now United States Patent No. 7,646,881 and 10/673,893, now United States Patent No. 7,630,509. These applications share a large percentage of the specification of the instant application.

There are appeals pending in partly conceptually related applications 10/955,099, 10/342,704, and 10/345,029.

Status of Claims

Claims 1-58 are pending in the application.

Although the Office Action states that 38-52, 55, 56, and 58 are withdrawn from consideration, applicant believes this to be a mistake because applicant traversed the previously issued restriction requirement and the Office Action did not set forth any reasons as to why applicant's traversal and reasoning therefor were incorrect. Furthermore, at best, these claims would be temporarily withheld from consideration, rather than withdrawn, since applicant will be entitled to consideration of these claims upon allowance of a generic claim.

Claims 1-22 and 54 are rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement.

Claims 1-9, 11, 13-18, 20-32, 34-37, 53-54 and 57 are rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 6,590,996 issued to Reed et al. on July 8, 2003.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Reed et al. in view of United States Patent Publication 2004/001626 applied for by Baudry et al.

Claims 12, 19, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reed et al. in view of "A guide tour of video watermarking" by Doerr et al.

The rejection of claims 1-37, 53-54 and 57, and objection to claim 12, is hereby appealed. A copy of the claims under appeal as now presented are appended to this brief in Appendix A.

Status of Amendments

All of applicant's amendments have been entered.

Summary of the Claimed Subject Matter

Watermarking of video signals is, generally, the inclusion within the video itself of additional information. This can be useful to provide an embedded identification of the source of a video, to keep track of where and for how long a video is played, and to communicate information via the video to an ancillary device. Prior art techniques for watermarking video signals typically encoded the additional information in an analog format within the video itself using the luminance of the video to carry the additional

information. However, the human visual system is very sensitive to the luminance signal, and so a person viewing a watermarked signal easily perceives distortion which is caused by the changes made to the video signal to convey the additional information when there is an attempt to increase the bit rate of the additional information beyond a certain point, e.g., beyond 120 bits per second. Thus, although the prior art's techniques of watermarking of video signals has had some success in certain applications, such success has been limited by the extremely small bit rate that is achievable without perceivable distortion by a person viewing the video signal carrying the additional information.

In previously filed United States Patent Application Serial No. 10/342704 I, along with my coinventor, recognized that the human visual system is much less sensitive to chrominance than to luminance. Therefore, we developed a system for digital watermarking a video signal that inserts the additional information of the watermarking signal on the chrominance component of the video signal rather than on its luminance signal. Thus, the additional information is "impressed" upon the chrominance component of the video signal. Advantageously, although there may be significant distortion of the chrominance component, especially when the additional information has higher bit rates than is achievable without perceivable distortion by the prior art, nevertheless such distortion will not be detected by the human visual system, provided it is appropriately managed. Thus, the additional information can have a higher bit rate as compared with that achievable by the prior art, e.g., bit rates greater than 150 bits per second can be achieved. Further advantageously, the additional data can be recovered from the video signal even after the video signal watermarked with the additional data is compressed using the Motion Picture Expert Group (MPEG)-1 and MPEG-2 encoding systems.

I have recognized that the system of Patent Application Serial No. 10/342704 required multiple frames of the video to accurately transmit the information on the chrominance component. This can be disadvantageous 1) in some applications, e.g., where finer granularity of the watermarking is required to provide a) better response time and b) improved resistance to temporal tampering with the video, and 2) under certain conditions, e.g., when there is a scene change, which can occur rapidly in the case of high speed movement in the video, such as occurs in a chase scene.

The watermarking of video can be improved, in accordance with the principles of the invention, by having one or more bits of watermark data carried via an average value of the chrominance component of each of various blocks of the video signal, on up to a per-frame basis. More specifically, one or more bits of the watermark data may be effectively placed into specified bit positions of the average value of at least a selected portion of the chrominance component of up to each block of up to each frame. Note that

typically, there are two chrominance portions, e.g., U and V when the video is represented in the YUV format, in the chrominance component. More specifically, each block of each frame of the original video signal may be modified to carry its own independent one or more bits of the watermark data in the average value of a chrominance portion that is selected to carry the watermark data for that block. Conceptually then, the value of the bit position of the average value of the selected chrominance portion that is to contain the watermark data for a block may be thought of as being replaced by the value of the bit of watermark data to be carried in that block.

In accordance with an aspect of the invention, only one of the chrominance portions carries watermark data for any particular block. The chrominance portion selected to carry the watermark data for any block may be independently selected for that block. In accordance with another aspect of the invention, the bit position of the average value that is to carry the watermark data is one of the bits of the integer portion of the average value.

In one embodiment of the invention, if necessary, the values of the selected chrominance portion of individual pixels of a block may be adjusted in order to cause the bit of the average value of the selected chrominance portion of the block that is to carry the watermark data to be the same as the value of the watermark data bit. This may be achieved by changing the value of the selected chrominance portion of various pixels in the block such that over the entire block the average of the value of the chrominance portion is changed so that the value of the select bit position of the average conforms to the value of the watermark data that is being placed in the selected bit position.

In accordance with an aspect of the invention, if the value of the bit position of the average value to contain the watermark data is already the same as the value of the watermark data bit, no change may be performed to any of the pixels of the block. However, if the value of the bit of the average value to contain the watermark data is the complement of the value of the watermark data bit to be carried by the block, at least the minimum change to the average value that will cause the bit to be changed to the value of the watermark data bit is performed on the average value. For example, if the bit of the average value to contain the watermark data is the second least significant bit of the integer portion of the average value, such a bit may always be changed to its complementary value by either adding or subtracting one to the average value. Doing so is preferable to adding two, which may also be used to always change the bit to its complementary value, because it introduces less change in the value of the average, and hence less change in the block, thereby reducing the chance of introducing a viewer-perceivable artifact. The change to the average value of the selected chrominance portion

of a block is implemented by adding or subtracting—, which may be accomplished by adding negative numbers—, a value to the selected chrominance portion of ones of the pixels of the block until the desired change in the average thereof is achieved.

In another embodiment of the invention, when using block-based frequency domain encoding of the video, such as one of the motion picture experts group (MPEG) standards, e.g., MPEG-1, MPEG-2, MPEG-4, the substitution of the bit of watermarked data may be achieved by adjusting the value of the DC coefficient, which corresponds to the average value, of at least one of the chrominance matrices for the block. In an exemplary such embodiment of the invention, the second least significant bit of the DC coefficient for a block is replaced with the value of the watermark bit that is desired to be impressed on the block.

In accordance with an aspect of the invention, which bit of the average value of the chrominance portion is designated to carry the watermark data may be a function of a texture variance of the block. It is advantageous to increase the significance of the bit position carrying the watermark data as the texture variance increases, because MPEG-like coding employs greater quantization step sizes for higher texture variances, and the use of such greater quantization step sizes could result in the elimination, e.g., filtering out, of the watermarking data if it is not positioned significantly enough. When using more significant bit positions, the values to be added or subtracted from the average value in order to change the value of a bit position carrying the watermark data to its complementary value may be greater than one. Any texture variance may be used, e.g., the texture variance of Y, U, or V, or a combination thereof.

In accordance with an aspect of the invention, whether or not the bit position carrying the watermark data was changed to its complement, a "margin" value may be added to the average value in order to better ensure that the bit of watermark data carried by the average value of the block survives any MPEG-like encoding, while minimizing the likelihood of perceivable artifacts resulting.

A receiver determines which of the chrominance components of a block are carrying the watermark data and extracts the bit of watermark data from the selected bit position of the integer portion of the average value of that chrominance component. The selected bit position may be determined from a texture variance of the block, e.g., the texture variance of the determined chrominance portion of the block or the texture variance of the luminance component.

Advantageously, better response time and improved resistance to temporal tampering with the video is achieved with respect to the prior art. Further advantageously, scene changes do not introduce errors into the impressed data. Yet an

additional advantage is that even if the original pixel domain version of the video is not available, but only a block-based frequency domain encoded version thereof, the video may be watermarked without conversion back to the pixel domain.

Independent claim 1 relates to a method of watermarking a video signal to include additional information therein, the method being performed by an apparatus for watermarking a video signal, the method including the step of automatically impressing at least a portion of the additional information upon a chrominance portion of the video signal by placing it in at least one selected bit position of a value derived from an average of the chrominance portion over a block of the video signal. Exemplary support in the specification is found at least at page 2, line 14 to page 4, line 22; page 7, line 1 to page 14, line 2; page 16, line 1 to page 23, line 22, page 28, line 28 to page 46, line 31, page 48, line 34 to page 51, line 7and associated FIGs. 1, 3, 5, 6, 7, 8, and 9.

Independent claim 23 relates to an apparatus for embedding additional watermarking data within a video signal, having a color selection unit for selecting a chrominance portion of a block of the video signal to carry a portion of the additional watermarking data and a data adder that adds information to pixels of the block of the video signal thereby causing a change in the average value of the selected chrominance portion so as to incorporate at least a portion of the additional watermarking data within the changed average value. Exemplary support in the specification is found at least at page 2, line 14 to page 4, line 22; page 7, line 1 to page 14, line 2; page 16, line 1 to page 23, line 22, page 28, line 28 to page 46, line 31, page 48, line 34 to page 51, line 7and associated FIGs. 1, 3, 5, 6, 7, 8, and 9.

Independent claim 34 relates to an apparatus for embedding additional watermarking data within a video signal, having means for selecting a chrominance portion of a block of the video signal to carry a portion of the additional watermarking data; and means for causing a change in the average value of the selected chrominance portion so as to incorporate at least a portion of the additional watermarking data within the changed average value. Exemplary support in the specification is found at least at page 2, line 14 to page 4, line 22; page 7, line 1 to page 14, line 2; page 16, line 1 to page 23, line 22, page 28, line 28 to page 46, line 31, page 48, line 34 to page 51, line 7and associated FIGs. 1, 3, 5, 6, 7, 8, and 9.

Independent claim 38 relates to a method for use in extracting watermark data from a watermarked video signal that is performed by an apparatus for extracting watermark data that was added to a video signal, wherein the watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, the method including the steps of automatically

selecting a chrominance portion that is likely to be carrying the watermark data in the average of the values of the chrominance portion for the block and automatically extracting the watermark data from the average of the values of the selected chrominance portion. Exemplary support in the specification is found at least at page 2, line 4 to page 4, line 23; page 14, line 3 to page 15, line 35; page 23, line 23 to page 28, line 22; page 28, line 28 to page 45, line 34, page 46, line 32 to page 48, line 33, page 51, line 8 to page 52, line 35, and associated FIGs. 2, 6, 7, 8, and 10.

Independent claim 50 relates to a receiver for use in extracting watermark data from a watermarked video signal, wherein the watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, the receiver including a color selector for indicating which chrominance portion is likely to be carrying the watermark data in the average of the values of the chrominance portion for the block, a block integrator for computing the average of the values of the chrominance portion for the block, and a bit selector that supplies as an output the watermark data from the average of the values of the selected chrominance portion. Exemplary support in the specification is found at least at page 2, line 4 to page 4, line 23; page 14, line 3 to page 15, line 35; page 23, line 23 to page 28, line 22; page 28, line 28 to page 45, line 34, page 46, line 32 to page 48, line 33, page 51, line 8 to page 52, line 35, and associated FIGs. 2, 6, 7, 8, and 10.

Independent claim 53 relates to a processor for embedding additional watermarking data within a video signal, the processor being operative to select a chrominance portion of a block of the video signal to carry a portion of the additional watermarking data, and to cause a change in the average value of the selected chrominance portion so as to incorporate at least a portion of the additional watermarking data within the changed average value. Exemplary support in the specification is found at least at page 2, line 14 to page 4, line 22; page 7, line 1 to page 14, line 2; page 16, line 1 to page 23, line 22, page 28, line 28 to page 46, line 31, page 48, line 34 to page 51, line 7and associated FIGs. 1, 3, 5, 6, 7, 8, and 9.

Independent claim 54 relates to a computer readable medium containing software in computer executable format for embedding additional watermarking data within a video signal, the software having a module adapted to cause a computer executing the module to automatically select a chrominance portion of a block of the video signal to carry a portion of the additional watermarking data and a module adapted to cause a computer executing the module to to automatically incorporate a change in the average value of the selected chrominance portion so as to incorporate at least a portion of the additional watermarking data within the changed average value. Exemplary support in

the specification is found at least at page 2, line 14 to page 4, line 22; page 7, line 1 to page 14, line 2; page 16, line 1 to page 23, line 22, page 28, line 28 to page 46, line 31, page 48, line 34 to page 51, line 7and associated FIGs. 1, 3, 5, 6, 7, 8, and 9.

Independent claim 55 relates to an apparatus for use in extracting watermark data from a watermarked video signal, wherein the watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, the apparatus having means for selecting a chrominance portion is likely to be carrying the watermark data in the average of the values of the chrominance portion for the block and means for extracting the watermark data from the average of the values of the selected chrominance portion. Exemplary support in the specification is found at least at page 2, line 4 to page 4, line 23; page 14, line 3 to page 15, line 35; page 23, line 23 to page 28, line 22; page 28, line 28 to page 45, line 34, page 46, line 32 to page 48, line 33, page 51, line 8 to page 52, line 35, and associated FIGs. 2, 6, 7, 8, and 10.

Independent claim 56 relates to a method for use in extracting watermark data from a watermarked video signal that is performed by an apparatus for extracting watermark data that was added to a video signal, wherein the watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, the method including the steps of automatically selecting a chrominance portion is likely to be carrying the watermark data in the average of the values of the chrominance portion for the block; and automatically extracting the watermark data from the average of the values of the selected chrominance portion. Exemplary support in the specification is found at least at page 2, line 4 to page 4, line 23; page 14, line 3 to page 15, line 35; page 23, line 23 to page 28, line 22; page 28, line 28 to page 45, line 34, page 46, line 32 to page 48, line 33, page 51, line 8 to page 52, line 35, and associated FIGs. 2, 6, 7, 8, and 10.

Independent claim 57 relates to an apparatus for embedding watermarking data within a video signal, having means for receiving a video signal in a frequency domain based format; and means for changing a DC coefficient of at least one block of the video signal to carry at least a portion of the watermarking data. Exemplary support in the specification is found at least at page 2, line 14 to page 4, line 22; page 7, line 1 to page 14, line 2; page 16, line 1 to page 23, line 22, page 28, line 28 to page 46, line 31, page 48, line 34 to page 51, line 7and associated FIGs. 1, 3, 5, 6, 7, 8, and 9.

Independent claim 58 relates to a system for embedding watermarking data within a video signal at a transmitter and recovering the watermarking data at a receiver, wherein the transmitter has a color selection unit for selecting a chrominance portion of a block of

the video signal to carry a portion of the additional watermarking data and a data adder that adds information to pixels of the block of the video signal thereby causing a change in the average value of the selected chrominance portion so as to incorporate at least a portion of the additional watermarking data within the changed average value and the receiver has a color selector for indicating which chrominance portion of the video signal incorporating at least a portion of the additional watermarking data is likely to be carrying the watermark data in the average of the values of the chrominance portion for received block, a block integrator for computing the average of the values of the chrominance portion for the received block, and a bit selector that supplies as an output the watermark data from the average of the values of the selected chrominance portion, wherein at least one of the color selection unit and the color selector comprises a prestored table in computer readable form that indicates for each area within at least a colorspace portion which chrominance portion should be selected for pixels within the each area. Since this claim covers both watermarking and watermark recovery, support is provided by the entire specification and all of the FIGs.

Grounds of Rejection to be Reviewed on Appeal

I. Are claims 1-22 and 54 properly rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement.

II. Are claims 1-9, 11, 13-18, 20-32, 34-37, 53-54 and 57 properly rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 6,590,996 issued to Reed et al. on July 8, 2003.

III. Are claims 10, 12, 19, and 33 are properly rejected under 35 U.S.C. 103(a) as being unpatentable over Reed et al. in view of various other references.

Argument

Issue I – Rejection of Claims 1-22 and 54 Under 35 U.S.C. 112, First Paragraph

Claims 1-22 and 54 are rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement. The Office Action essentially states that the specification does not support or disclose extracting the watermark or encoding the chrominance bits "automatically". More specifically, per the Advisory Office Action of June 21, 2010, it seems that the Office Action wants applicant to show that the word automatically appears somewhere in the specification.

This ground of rejection is respectfully traversed for the following reason.

The Advisory Office Action is mistaken in its belief that 35 U.S.C. 112, first paragraph requires that the exact word "automatically" to appear in the specification. However, there is clearly no requirement that a word that appears in the claim must find the exact same word used in the specification. Rather, the requirement of the written description of the invention is that it merely must enable a skilled person to practice the invention as claimed. Applicant's specification easily meets this requirement. In this regard, note that 35 U.S.C. 112, first paragraph states:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same …

More specifically, as is well known, the word "automatically", as an adjective, has the meaning "having the capability of starting, operating, moving, etc., independently", and, idiomatically, the phrase "on automatic" means, "being operated or controlled by or as if by an automatic device". See, for example, www.dictionary.com at http://dictionary.reference.com/browse/automatically. Also as is well known, the opposite of "automatically" is "manually", which means, "worked or done by hand and not by machine" according to http://www.merriam-webster.com/dictionary/manually. So, when an apparatus (which is a synonym for machine) is shown and its operation explained in a specification, such as in the instant specification, unless human control is specifically required, one of ordinary skill in the art would know that such apparatus operates automatically, i.e., by itself. By contrast, when a human performs a process, that is called a "manual" process.

If a process is taught in a specification that can be performed either automatically or manually, the applicant has the right, given by 35 U.S.C. 112, second paragraph, which authorizes the inventor to define the subject matter of his invention by selection of the specific language used in the claims, to define his invention to be a) the process whether performed automatically or manually, b) the process performed only manually, or c) the process performed automatically. Furthermore, neither the word automatically, nor the word manually, need be in the specification. Rather, all that is required is that one of ordinary skill in the art would understand from the description that the process can be performed manually or automatically.

Applicant's specification clearly provides for the various processes disclosed therein to be performed automatically. Applicant's specification specifically states at page 5, line to page 6, line 32:

> The following merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. Furthermore, all examples and conditional language recited herein are principally intended expressly to be only for pedagogical purposes to aid the reader in understanding the principles of the invention and the concepts contributed by the inventor(s) to furthering the art, and

are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that any block diagrams herein represent conceptual views of illustrative circuitry embodying the principles of the invention. Similarly, it will be appreciated that any flow charts, flow diagrams, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

The functions of the various elements shown in the FIGs., including any functional blocks labeled as "processors", may be provided through the use of dedicated hardware as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, network processor, application specific integrated circuit (ASIC), field programmable gate array (FPGA), read only memory (ROM) for storing software, random access memory (RAM), and non volatile storage. Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the FIGS. are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

In the claims hereof any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a) a combination of circuit elements which performs that function or b) software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The invention as defined by such claims resides in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. Applicant thus

> regards any means which can provide those functionalities as equivalent as those shown herein.
>
> Software modules, or simply modules which are implied to be software, may be represented herein as any combination of flowchart elements or other elements indicating performance of process steps and/or textual description. Such modules may be executed by hardware which is expressly or implicitly shown. (Emphasis added.)

From the foregoing, the FIGs., and their associated description, one of ordinary skill in the art would readily recognize that the various process taught in the specification may be performed automatically.

The word "automatically" was inserted into the claims to simply clarify that the methods are performed by a machine, e.g., the taught receiver or transmitter, and not by a person. Note that the specification a) discloses in FIG. 1 an exemplary transmitter for digital watermarking a video signal, in accordance with the principles of the invention, and b) discloses in FIG. 2 an exemplary receiver for recovering the additional data of a video signal containing digital watermarking on the chrominance signal thereof, in accordance with the principles of the invention. Thus, since there is a machine, i.e., the exemplary transmitter, disclosed in the specification, for performing the encoding and there is a machine, i.e., the exemplary receiver, disclosed in the specification, for performing the decoding, there is support in the specification for automatically performing the methods claimed, e.g., when the methods are performed, as disclosed, by a machine and not by a human.

As amended, the language of the independent method claims more clearly represents the intention that the step recited therein is performed automatically, i.e., it is **not** a human mental step. There was no intention to change the scope of the invention. Indeed, it was noted that for a video signal, which is called for in the amended claims, it would be impossible in practical usage for a human to perform the recited step of the independent method claims in a timely manner to actually implement the invention.

Furthermore, these limitations were already required by, if not explicitly set forth in, similar apparatus claims. For example, claim 23 already recited "a data adder that adds information to pixels of said block of said video signal thereby causing a change in the average value of said selected chrominance portion so as to incorporate at least a

portion of said additional watermarking data within said changed average value", and of course, being an apparatus, it would perform the changes to the video signal automatically. Likewise, claim 54 originally recited "Software in computer executable format for embedding additional watermarking data within a video signal, said software comprising: a module to select a chrominance portion of a block of said video signal to carry a portion of said additional watermarking data; and a module to a change in the average value of said selected chrominance portion so as to incorporate at least a portion of said additional watermarking data within said changed average value", and again, such software would cause the computer to execute the modules, so that, in other words, it would perform the recited functions automatically.

Thus, it is believed insertion of the word "automatically" merely made explicit what was already implicit in the claims. Moreover, even if one chooses to view the insertion of the word "automatically" as a new limitation, such a limitation is clearly supported by the written description. As a result, claims 1-22 and 54 comply with the written description requirement and meet the requirements of 35 U.S.C. 112, first paragraph.

Note that the claims of United States Patents 7,646,881 and 7630509, issued to applicant and based on essentially the same disclosure, were similarly amended to include the word "automatically" into various method steps that had been presented originally without the word "automatically". For both of those patents it was conceded by the United States Patent and Trademark Office that there was sufficient bases in the specification to support the amendment.

Thus, use of the word "automatically" in various method steps of the claims does not render the specification deficient under 35 U.S.C. 112, first paragraph for failure to meet the written description requirement.

Issue II – Rejection of Claims Under 35 U.S.C. 102(b)

Claims 1-9, 11, 13-18, 20-32, 34-37, 53-54 and 57 are rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 6,590,996 issued to Reed et al. on July 8, 2003.

This ground of rejection is respectfully avoided for the following reasons.

In applicant's response to the Final Office Action, applicant pointed out that his claims speaks of chrominance, and explained what chrominance is. The Advisory Office Action stated that it recognizes that chrominance is a term that does not have to be argued for or mentioned a lot, but then says that the whole Reed et al. reference "is related with chrominance or chrominance plane".

It is true that the Reed et al. reference mentions chrominance. However, the mere mention of chrominance by a reference is **not** sufficient to form a proper rejection of the instant application based on 35 U.S.C. 102. Rather, it must be shown that the chrominance is modified as called for by applicant's claim. This the various Office Actions have **not** done.

Furthermore, the Advisory Office Action, suggests that column 38, lines 10-25 of Reed et al. discloses a transform domain encoding process which uses the characteristic color of the block, which is computed as the average color value for the block. However, as explained in some further detail hereinbelow, the characteristic color is **not** a chrominance. So there does seem to be some confusion on the part of the Office Action as to the difference between chrominance and color. Furthermore, there is **no** portion of the additional information that is placed by Reed et al. into this calculated characteristic color. In other words, the average (characteristic) color, even if it were deemed to correspond to applicant's average chrominance—which it does **not**—is **not** modified as required by applicant's claims. Rather, the calculated average (characteristic) color is simply used to decide which color channels to modify. Also, unlike applicant's claims, in Reed et al. there is **no** bit position of the average (characteristic) color that is selected. Clearly then, the calculated average (characteristic) color is **not** modified to have any portion of the watermark data placed in a bit position thereof.

To review the rejections of the various Office Actions on this point in some more detail, regarding the rejection in view of Reed et al. in the first Office Action, applicant explained that Reed et al. does **not** teach to place the bits of watermark data into at least one selected bit of an average value of a chrominance portion over a block of the video signal, as required by applicant's independent claim 1. Rather, Reed et al. teaches

employing the average (characteristic) color of the block to look up the corresponding color channels in which to embed the additional data. (See Reed et al. column 2, lines 40-52, column 38, lines 10-47.) However, in Reed et al., the additional information is **not** encoded so that it is carried by the average (characteristic) color value, as required by applicant's claims. Furthermore, the modifications of the image to add thereto the watermark data by Reed et al. do **not** place the actual bit values of the watermark data into at least one selected bit of the average value of the **chrominance** potion of a block. (Again, see Reed et al. column 2, lines 40-52, column 38, lines 10-47. and further note in particular the difference between color versus chrominance.)

By contrast, as explained in more detail hereinbelow, applicant's claims place the actual information, i.e., the bit, to be transmitted as the watermark data, into at least one selected bit position of the value derived from the average of the **chrominance** portion over a block of said video signal. In other words, what is required by applicant's claim is that the actual watermark data bit to be received at the watermark receiver be placed by the watermark transmitter into the selected at least one bit position. Once this is done, after transmission, all that remains for applicant's receiver to do to recover the watermark data is to identify the particular bit position and extract the watermark data therefrom.

Similarly, Reed et al. does **not** teach adding information to pixels of the block of the video signal to thereby cause a change in the average (characteristic) color value of a selected **chrominance** portion so as to incorporate at least a portion of additional watermarking data within a changed average value, as required by applicant's independent claims 23, 34, 53, 54, 57, and 58. This is because, as mentioned, in Reed et al., the additional information is **not** encoded so that it is carried by the average (characteristic) color value.

Note that lines 29-36 of column 15 of Reed et al., cited by the First Office Action in support of its position, do **not** teach that for which they are set forth by the FirstOffice Action. Rather, these lines appear to teach that the message inserted may be multiple bits or as small as a single bit. They do **not** teach that such bit is inserted in an average value of the **chrominance** portion. Similarly, column 2, lines 50-51, of Reed et al., appears to teach along the lines of that which was mentioned above, namely, that the average

(characteristic) color value of the block is used to look up the corresponding color channels in which to embed the block. But again, it does **not** teach that the additional information is encoded so that it is carried by the average (characteristic) color value, or even the average of any single color, and certainly **not** the average value of the **chrominance**.

Regarding independent claims 38, 50, 55, 56, and 58 which are directed to recovering the watermark data from a watermarked video signal, these claims extract the watermark data from the average value of one of the **chrominance** portions. Since Reed et al. does **not** place watermark data in the average value of any of **chrominance** portions, Reed et al. can**not** recover watermark data from the average value of any of **chrominance** portions. Consequently, independent claims 38, 50, 55, 56, and 58 are allowable over Reed et al.

In response to the foregoing arguments, the Final Office Action stated that Reed et al., in column 38, lines 20-24, "discloses that color channels to which the watermark is applied are altered depending on a characteristic color of an image block to be transformed to transform coefficient for watermark encoding, which can be computed as an average of the color for that block". Therefore, the Final Office Action concluded, the method of Reed et al., "is to modify to effect the desired changes to the image, so it is readily apparent that only selected bits of the color block image will be used". The Final Office Action continued, stating: "If the invention uses all the bits, it will not obtain the desired changes to the image". The Final Office Action further stated that, "the characteristic of color is computed as an average of the transform coefficients for watermarking encoding" and "[i]n other words, the transform coefficients are bits, and the average has to be the average values of these transform coefficients".

To the best that applicant can understand the position of the Final Office Action, as the language and reasoning is rather unclear, especially given what it appears is actually taught by Reed et al., applicant believes that his position as set forth with regard to the First Office Action is correct and that Reed et al. does **not** teach applicant's invention as claimed. In this regard, please note the following additional points.

It appears that the Office Action has misconstrued the meaning of applicant's claims and the teaching of the Reed et al. reference. First, as already mentioned hereinabove, the Final Office Action appears continues to confuse, or possibly conflate, "**chrominance**", which is a specific, well-known term in video signals, with the color components or channels of an image. The lines of Reed et al. cited by the Office Action, and indeed the entire section from column 37, line 63 through column 38, line 51, are discussing color components, e.g., red (R), green (G), and blue (B), which are **not chrominance** components. So even if the Office Action understands the difference between color and chrominance, it appears that this difference is **not** being properly taken into account.

It is well-known that, as applied to video signals, luminance represents the brightness in an image i.e., the "black and white" or achromatic portion of the image. Thus, luminance represents the image without any color. This is the Y of the video signal when the video signal is represented using Y, U, and V. For color systems, luminance, Y, is often paired with **chrominance**, which represents the color information. Chrominance is the U and V of the color video signal represented using Y, U, and V.

More specifically, chrominance is usually represented as two color-difference components: U = B' – Y' (blue – luma) and V = R' – Y' (red – luma). In composite video signals, the U and V signals modulate a color subcarrier signal, and the result is referred to as the chrominance signal; the phase and amplitude of this modulated chrominance signal correspond approximately to the hue and saturation of the color. Rearranging RGB color signals into luminance and chrominance allows the bandwidth of each to be determined separately. The idea of transmitting a color television signal with distinct luminance and chrominance components originated with Georges Valensi, who patented the idea in 1938. Valensi's patent application described: "(t)he use of two channels, one transmitting the predominating color (signal T), and the other the mean brilliance (signal t) output from a single television transmitter to be received not only by color television receivers provided with the necessary more expensive equipment, but also by the ordinary type of television receiver which is more numerous and less expensive and which reproduces the pictures in black and white only." Previous schemes for color television

systems, which were incompatible with existing monochrome receivers, transmitted RGB signals in various ways.

Thus, applicant's claims, which relate to **chrominance**, are very different from the cited section of Reed et al., which relates to color channels, e.g., red (R), green (G), and blue (B).

Reed et al. actually discusses mapping a desired specified change to an image attribute which will indicate watermark data, the change being straightforwardly implementable by a change to the color components (apparently also referred to therein as color values and color channels), in a manner that will be difficult for a viewer to detect. Note that the color components mentioned in the cited section of Reed et al. are **not** the same as the recited **chrominance** component of applicants' claims. This is implicitly recognized in Reed et al. and confirmed by the fact that Reed et al. discusses a mapping scheme based on luminance **and chrominance** (which is very different from applicant's claimed invention), as opposed to color, in the immediately preceding section.

As already noted above, it is true that the cited section Reed et al. talks about the average (characteristic) color value of a region. However, such characteristic color is **not** a **chrominance** of the region, **nor** is it the average value of the **chrominance** of the region. Furthermore, Reed et al. does **not** teach to modify this characteristic color. Rather, Reed et al. teaches to use the average (characteristic) color value of the region to look up in a table which of the color channels should be modified to implement the desired changes in the image. (See Reed et al., column 38, lines 14-24 and 30-39.)

Applicant recognizes that Reed et al. points out that the average (characteristic) color value may be computed as average or DC component of the color for that block. However, the color of the block is **not** the same as the DC coefficient of a transform block for any particular **single** color of the block. Rather, it is the average of **all** of the colors in the entire block.

Given the foregoing, it is clear that the Office Action's statement that "the characteristic of the color is computed as an average of the transform coefficients for watermarking encoding", is simply factually **incorrect** (as well as grammatically uncertain). The average (characteristic) color value, as noted above, is the average color

over the entire block, and it does **not** appear to be determined by averaging the transform coefficients, **nor** does it appear that it could be so calculated. Thus, the Office Action's statement that "the transform coefficients are bits, and the average has to be average values of these transform coefficients or bits", is likewise incorrect (as well as grammatically uncertain), but in any event it is clear that the average of the transform coefficients is **not** the DC value of the transform coefficients.

Furthermore, it is important to recognize that Reed et al. does **not** teach or suggest that it is the DC component of the color for the block, let alone any particular DC coefficient of the various color channels, that is to be modified. Rather, Reed et al. teaches the use of the average (characteristic) color value, to determine which color or colors, i.e., which color channels, are to be modified and that transform coefficient**s** to encode a watermark can be targeted to specific color channel**s** for each image block. In other words, there is **no** specific teaching or suggestion to modify the DC component or coefficient of a transform of any of the color channels to carry the watermark. In short then, the Final Office Action's statement on this point is also irrelevant because Reed et al. does not teach to modify this average (characteristic) color value.

Furthermore, applicant suggests that the Final Office Action's notion of modifying the average (characteristic) color value, alleged to be the DC component, of a block in an arrangement such as disclosed by Reed et al. could be counter productive, and hence is actually taught away from Reed et al. This is because it is the characteristic average (characteristic) color value of the block that is used in a receiver of Reed et al. as the basis for the lookup to determine which color channels have been changed and are carrying the watermark data. (See Reed et al, column 38, lines 48-51.) However, if the DC component, i.e., the characteristic color, has been modified, the lookup will be altered, and perhaps the wrong color channels will be identified as carrying the watermark data. If so, because such wrongly identified color channels will **not** actually be carrying any watermark data, attempts to retrieve from them watermark data will result in errors. Thus, notwithstanding the Office Action's suggestion to the contrary, it appears that the cited section of Reed et al. actually teaches away from modifying the characteristic color, of the block.

Additionally, as mentioned above but presented now in more detail, applicant's claims, e.g., claim 1, require automatically impressing at least a portion of said additional information upon a chrominance portion of said video signal by **placing** it in at least one selected bit position of a value derived from an average of said chrominance portion over a block of said video signal. In other words, the actual portion of the additional information itself is **placed** in the at least one selected bit position of the value. For example, if the information 1 0 is to be placed in the second and third bit position of the average value, the average value is adjusted so that its second bit has a value of 0 and its third bit has a value of 1. What this does is to facilitate the extraction of the information, because once one knows which bit position(s) of the value contains the additional information, one can immediately directly see it, and simply copy the specified bit(s) in order to extract the additional information. Continuing the example above, one can simply look at the second and third bit of the average value and see that it is 1 0, and thus know the additional information embedded thereat is 1 0. Note that while the foregoing is described in terms of two bits, the same principles apply for embedding a single bit at a time or more bits than two at a time.

However, **no** such placement is taught or suggested by Reed et al. Rather, Reed et al. uses the block's average (characteristic) color value, which seems to be the average color over the whole block, as noted above, and a) **not** the average of any particular one color channel and b) **not** the average of a chrominance signal, **only** to look up the color channel(s) in which the watermark is expected to be encoded and to decode the watermark from those color channel(s). (See Reed et al., column 38, lines 48-51). Nothing is placed therein.

It is clear then, that, notwithstanding any statements by the Office Actions to the contrary, applicant's claims do **not** recite simply using selected bits of the block to carry the watermark. In fact, according to applicant's claims, the bits employed to carry the watermark data are bits of a value derived from an average of a **chrominance** portion of the block. Such an average value is computed from the values of the **chrominance** portion for each pixel in the block. Moreover, in many embodiments of applicant's invention, the change to the average value is indirectly made, by actually changing

various pixels within the block to result in the necessary change to the average value of the **chrominance**, and **not** by changing the average value of the **chrominance** directly, which itself in such cases is **not** actually part of the video signal. (Note that it seems that the average value of the **chrominance** can only be changed directly in embodiments that use a frequency-based representation of the video signal, e.g., MPEG 1-, 2-, and 4-type representations, and then only for I frames for which the DC coefficient of each of the chrominance matrices actually represents the average value of their respective chrominance portions, as the DCT coefficients of the P and B frames represent error signals rather than encoding the frames directly.)

Since all of the dependent claims that depend from the currently amended independent claims include all the limitations of the respective independent claim from which they ultimately depend, each such dependent claim is also allowable over Reed et al. under 35 U.S.C. 102.

Issue III – Rejection of Claims Under 35 U.S.C. 103(a)

Claims 10, 12, 19, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reed et al. in view of various other references.

Each of these grounds of rejection applies only to dependent claims, and each is predicated on the validity of the rejection under 35 U.S.C. 102 given Reed et al. Since the rejection under 35 U.S.C. 102 given Reed et al. has been overcome, as described hereinabove, and there is no argument put forth by the Office Action that any of the additional references supplies that which is missing from Reed et al. to render the independent claims anticipated, these grounds of rejection cannot be maintained.

Therefore, applicant's claims 10, 12, 19, and 33 are allowable over Reed et al. under 35 U.S.C. 103(a).

Conclusion

In view of the foregoing, it is submitted that the Examiner is in error. It is, accordingly, respectfully requested that the rejections of applicant's claims noted hereinabove be reversed and the application passed to issue.

Respectfully,

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Claims Appendix

Claims

1. A method of watermarking a video signal to include additional information therein, said method being performed by an apparatus for watermarking a video signal, the method comprising the step of automatically impressing at least a portion of said additional information upon a chrominance portion of said video signal by placing it in at least one selected bit position of a value derived from an average of said chrominance portion over a block of said video signal.

2. The invention as defined in claim 1 wherein said portion of said additional information is a bit.

3. The invention as defined in claim 1 wherein said additional information replaces at least one bit of said value derived from said average of said chrominance portion over said block.

4. The invention as defined in claim 1 wherein said value derived from an average of said chrominance portion over a block of said video signal is the average of the values of said chrominance portion for each pixel of said block.

5. The invention as defined in claim 1 wherein said additional information is not substantially perceivable by the human visual system when said video signal including said additional information is displayed on a display device.

6. The invention as defined in claim 1 wherein said additional information was impressed by changing the value of said chrominance portion of various pixels of said block, and wherein the magnitude of the change in value any pixel is a function of the amount of change that can be introduced into said pixel without resulting in an artifact that is substantially detectable by the human visual system.

7. The invention as defined in claim 1 wherein said additional information was impressed by changing the value of said chrominance portion of various pixels of said block, and wherein the magnitude of the change in value any pixel does not exceed the amount of change that can be introduced into said pixel without resulting in an artifact that is substantially detectable by the human visual system.

8. The invention as defined in claim 1 wherein the position of said selected bit is fixed for at least one block of at least one frame of said video signal.

9. The invention as defined in claim 1 wherein the position of said selected bit is dynamically determined for at least one block of at least one frame of said video signal.

10. The invention as defined in claim 1 wherein the position of said selected bit is determined based on a texture variance of said block.

11. The invention as defined in claim 1 wherein said bit position into which said additional information is impressed is a bit of the integer portion of said value derived from said average.

12. The invention as defined in claim 1 wherein said block of said video signal is in a reduced resolution format such that for each 2x2 luminance block of an original version of said video signal, had said original version of said video signal been in 4-4-4 representation, there remains only one Y, one U, and one V value.

13. The invention as defined in claim 1 wherein said average of said chrominance portion over said block of said video signal is a DC coefficient of said block in a frequency domain representation of said block of said video signal.

14. The invention as defined in claim 1 wherein said additional information was placed in said at least one selected bit position in a manner that makes a minimum change to said average.

15. The invention as defined in claim 1 wherein said additional information was placed in said at least one selected bit position by adding a value to said average so as to make the value of said at least one bit position of said value derived from said average the same as said additional information to be impressed.

16. The invention as defined in claim 1 wherein said additional information was placed in said at least one selected bit position by adding a value to said average so as to make said at least one bit position the same in said value derived from said average as said additional information to be impressed while making only a minimum change to the value of said average when impressing said data.

17. The invention as defined in claim 1 wherein said additional information was placed in said at least one selected bit position by adding a value to said average so as to make said at least one bit position of said value derived from said average the same in value as said additional information to be impressed, said adding to said average having been achieved by adding an amount to the said chrominance portion of various pixels of said block, said additions to said pixel chrominance portions being made until a total of such additions equals the product of said value and the number of pixels in a block, said additions being independent of any other changes made to the chrominance portion of said pixels.

18. The invention as defined in claim 1 wherein said video signal further comprises a margin signal added thereto to reduce the likelihood that said additional information will be eliminated should said video signal undergo quantization

19. The invention as defined in claim 1 wherein said video signal further comprises a margin signal added thereto to reduce the likelihood that said additional information will be eliminated should said video signal undergo motion picture experts group (MPEG)-type encoding.

20. The invention as defined in claim 1 wherein said additional information was placed in said at least one selected bit position by adding only a minimum necessary amount to said average so that in said value derived from said average said at least one bit position is made to have the same value as said additional information to be impressed and said value derived from said average is within a safe range.

21. The invention as defined in claim 1 wherein said additional information is interleaved within said video signal with respect to its ordering prior to undergoing a process to be impressed therein.

22. The invention as defined in claim 1 wherein said additional information is channel encoded within said video signal.

23. Apparatus for embedding additional watermarking data within a video signal, comprising:

a color selection unit for selecting a chrominance portion of a block of said video signal to carry a portion of said additional watermarking data; and

a data adder that adds information to pixels of said block of said video signal thereby causing a change in the average value of said selected chrominance portion so as to incorporate at least a portion of said additional watermarking data within said changed average value.

24. The invention as defined in claim 23 wherein said color selection unit comprises a prestored table in computer readable form that indicates for each area within at least a colorspace portion which chrominance portion should be selected for pixels within said each area.

25. The invention as defined in claim 23 further comprising a block interleaver that interleaves said additional watermarking data prior to said additional watermarking data being incorporated within said changed average value.

26. The invention as defined in claim 23 further comprising a channel encoder that channel encodes said additional watermarking data prior to said additional watermarking data being incorporated within said changed average value.

27. The invention as defined in claim 23 wherein said data adder modifies only a said selected chrominance portion of said pixels and further comprising a multiplexer for multiplexing at least the unmodified chrominance portion of said pixels and said modified chrominance portion of said pixels.

28. The invention as defined in claim 23 wherein said data adder further comprises a bit mapper.

29. The invention as defined in claim 23 wherein said data adder further comprises a texture masking unit that determines a amount of change in said chrominance portion that a pixel can endure while minimizing the likelihood of a visible artifact resulting, and wherein said data adder adds no more than said amount to said pixel.

30. The invention as defined in claim 23 wherein said data adder adds a further value to pixels of said block of said video signal thereby causing the resulting new average value to be within a safe range.

31. The invention as defined in claim 23 wherein said data adder changes said average value by the least amount necessary to carry said additional watermark data.

32. The invention as defined in claim 23 wherein said data adder adds a further value to pixels of said block of said video signal thereby causing the resulting new average value to be within a safe range and wherein said data adder further adds to pixels of said block the value that changes said average value by the least amount possible.

33. The invention as defined in claim 23 wherein said video signal has the same resolution before and format after being watermarked by said video signal, but wherein said apparatus operates in a reduced resolution format such that for each 2x2 luminance block of an of said video signal before watermarking, had said video signal before watermarking been in 4-4-4 representation, there remains only one Y, one U, and one V value in said reduced resolution format of said video signal.

34. Apparatus for embedding additional watermarking data within a video signal, comprising:

means for selecting a chrominance portion of a block of said video signal to carry a portion of said additional watermarking data;

means for causing a change in the average value of said selected chrominance portion so as to incorporate at least a portion of said additional watermarking data within said changed average value.

35. The invention as defined in claim 34 wherein said means for causing a change changes said average value by placing in a selected bit position thereof at least a portion of said additional information.

36. The invention as defined in claim 34 wherein said means for causing a change changes said average value by placing in a selected bit position thereof at least a portion of said additional information and further changes said average value so it is within a safe range.

37. The invention as defined in claim 34 wherein said means for causing a change effectuates said change in said average value by changing the values of said selected chrominance portion of one or more of the pixels of said block.

38. A method for use in extracting watermark data from a watermarked video signal that is performed by an apparatus for extracting watermark data that was added to a video signal, wherein said watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, the method comprising the steps of:

automatically selecting a chrominance portion that is likely to be carrying said watermark data in said average of said values of said chrominance portion for said block; and

automatically extracting said watermark data from said average of said values of said selected chrominance portion.

39. The invention as defined in claim 38 further comprising the step of determining which bit position of said average of said values is carrying said watermark data, and wherein said extracting step extracts the value of said bit position.

40. The invention as defined in claim 38 further comprising the step of determining which bit position of said average of said values is carrying said watermark data as a function of a busyness of said block, and wherein said extracting step extracts the value of said bit position.

41. The invention as defined in claim 38 wherein said determining step further comprises the steps of:

making a determination for each pixel in said block as to which chrominance portion is most likely to tolerate a change in its value and not introduce thereby a visible artifact; and

choosing as said selected chrominance portion the chrominance portion that was determined in said making step for the most pixels of said block.

42. The invention as defined in claim 41 wherein said determination in said making step is made for at least one pixel of said block as a function of a prestored table in computer readable form that indicates for each area within at least a colorspace portion which chrominance portion should be selected for pixels within said each area.

43. The invention as defined in claim 41 wherein said determination in said making step is made for at least one pixel of said block as a function of a calculation that indicates which chrominance portion should be selected for a pixel as a function of values of said pixel.

44. The invention as defined in claim 38 further comprising the step of deinterleaving said watermark data after it is extracted.

45. The invention as defined in claim 44 further comprising the step of channel decoding said deinterleaved extracted watermark data.

46. The invention as defined in claim 38 further comprising the step of channel decoding said extracted watermark data.

47. The invention as defined in claim 38 further comprising the step of computing said average of the values of said chrominance portion of the pixels of said at least one block of said at least one frame from the values of said chrominance portion of said pixels of said at least one block of said at least one frame.

48. The invention as defined in claim 38 wherein said block of said video signal is in a reduced resolution format such that for each 2x2 luminance block of an original version of said video signal, had said original version of said video signal been in 4-4-4 representation, there remains only one Y, one U, and one V value.

49. The invention as defined in claim 48 further comprising the step of decimating an original video signal to produce said watermarked video signal with a reduced resolution format such that for each 2x2 luminance block of said original video signal, had said original video signal been in 4-4-4 representation, there remains only one Y, one U, and one V value.

50. A receiver for use in extracting watermark data from a watermarked video signal, wherein said watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, said receiver comprising:

a color selector for indicating which chrominance portion is likely to be carrying said watermark data in said average of said values of said chrominance portion for said block;

a block integrator for computing said average of said values of said chrominance portion for said block; and

a bit selector that supplies as an output said watermark data from said average of said values of said selected chrominance portion.

51. The invention as defined in claim 50 further comprising a block variance calculator that determines, based on at least one texture variance of said block, which bit position of said average of said values of said selected chrominance portion should be supplied as said watermark data by said bit selector.

52. The invention as defined in claim 51 a decimator that produces said watermarked video signal from an original video signal such that for each 2x2 luminance block of said original video signal, had said original video signal been in 4-4-4 representation, there remains only one Y, one U, and one V value in said watermarked video signal.

53. A processor for embedding additional watermarking data within a video signal, said processor being operative:

to select a chrominance portion of a block of said video signal to carry a portion of said additional watermarking data; and

to cause a change in the average value of said selected chrominance portion so as to incorporate at least a portion of said additional watermarking data within said changed average value.

54. A computer readable medium containing software in computer executable format for embedding additional watermarking data within a video signal, said software comprising:

a module adapted to cause a computer executing said module to automatically select a chrominance portion of a block of said video signal to carry a portion of said additional watermarking data; and

a module adapted to cause a computer executing said module to to automatically incorporate a change in the average value of said selected chrominance portion so as to incorporate at least a portion of said additional watermarking data within said changed average value.

55. Apparatus for use in extracting watermark data from a watermarked video signal, wherein said watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, said apparatus comprising:

means for selecting a chrominance portion is likely to be carrying said watermark data in said average of said values of said chrominance portion for said block; and

means for extracting said watermark data from said average of said values of said selected chrominance portion.

56. A method for use in extracting watermark data from a watermarked video signal that is performed by an apparatus for extracting watermark data that was added to a video signal, wherein said watermark data is carried in at least one bit position of an average of the values of a chrominance portion of the pixels of at least one block of at least one frame, said method comprising the steps of:

automatically selecting a chrominance portion is likely to be carrying said watermark data in said average of said values of said chrominance portion for said block; and

automatically extracting said watermark data from said average of said values of said selected chrominance portion.

57. Apparatus for embedding watermarking data within a video signal, comprising:

means for receiving a video signal in a frequency domain based format; and

means for changing a DC coefficient of at least one block of said video signal to carry at least a portion of said watermarking data.

58. A system for embedding watermarking data within a video signal at a transmitter and recovering said watermarking data at a receiver, wherein:

said transmitter comprises:

a color selection unit for selecting a chrominance portion of a block of said video signal to carry a portion of said additional watermarking data; and

a data adder that adds information to pixels of said block of said video signal thereby causing a change in the average value of said selected chrominance portion so as to incorporate at least a portion of said additional watermarking data within said changed average value; and

said receiver comprises:

a color selector for indicating which chrominance portion of said video signal incorporating at least a portion of said additional watermarking data is likely to be carrying said watermark data in said average of said values of said chrominance portion for received block;

a block integrator for computing said average of said values of said chrominance portion for said received block; and

a bit selector that supplies as an output said watermark data from said average of said values of said selected chrominance portion;

wherein at least one of said color selection unit and said color selector comprises a prestored table in computer readable form that indicates for each area within at least a colorspace portion which chrominance portion should be selected for pixels within said each area.

Evidence Appendix

None

Related Proceedings Appendix

None